

SECTION 11 5311.10

GLOVEBOX FABRICATION

LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the Engineering Standards Manual (ESM) Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Information within "stars" is provided as guidance to the author responsible for revising the specification. Delete information within "stars" during editing.

This specification serves as a template. The specification was prepared by an organization operating under a quality assurance program that meets the requirements of 10 CFR 830 [suitable for ML-1 through ML-4 projects]. Implementation of this specification requires modification to the specification to meet project-specific requirements. Responsibility for application of this specification to meet project-specific requirements lies with the organization modifying or implementing the specification. The organization modifying the specification shall apply a graded approach to quality assurance based on the management level designation of the project. When this specification is used with nuclear facilities subject to 10 CFR 830, modification to this specification must be performed by an individual or organization operating under a quality assurance program that meets the requirements of that CFR.

This specification is a general specification covering a wide range of nuclear materials glovebox applications. It is to be used for fabrication of gloveboxes when combined with build-to-print fabrication drawings. If a design/build procurement is needed, this section should be edited in conjunction with Section 11608 – Glovebox Design.

This specification primarily defines requirements for fabrication of stainless steel gloveboxes used for confinement of nuclear materials. Other materials may be used for the fabrication of the glovebox, including aluminum, provided that the process and corrosive requirements inside the glovebox are met. Redefine the specification requirements when specifying a glovebox fabricated from a material different than stainless steel.

This specification is most applicable to new acquisitions, but may have application with modifications or repair work to existing gloveboxes.

NOTE: Portions of this specification consist of quotations and paraphrases from the American Glovebox Society, Guideline for Gloveboxes, AGS-G001-1998. In the interest of providing a useable and readable specification, quotations and paraphrases have not been footnoted throughout the text. Paraphrases and quotations have been identified in italics. The users of this specification are encouraged to review the Guideline for Gloveboxes and to use the guideline appropriately. During revision and final issue of the specification, change italics to standard text.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glovebox Shells
- B. Open-Front Boxes
- C. Airlocks
- D. Glovebox Support Stands
- E. Gloveports
- F. Windows
- G. Filter Housings
- H. Shell Penetrations
- I. Access and Service Panels
- J. Material Transfer Devices
- K. Radiation Shielding
- L. Glovebox Linings
- M. Pressure Relief Devices
- N. Other Glovebox Appurtenances

1.2 SCOPE

- A. This specification establishes the technical requirements for the materials of construction, fabrication, testing, shipment, and quality assurance (QA) of gloveboxes, their support stands, and components or appurtenances of gloveboxes.
- B. The technical requirements of this specification are applicable to gloveboxes used for the primary and secondary confinement of nuclear materials. Additional technical requirements are provided in the contract drawings. Any additional requirements specific to a given glovebox are identified in contract documentation identified in Division 1 documents.
- C. The following is a summary of supplier responsibilities described in this specification:
 - 1. Fabricate gloveboxes in accordance with this specification and the contract drawings.

2. Procure equipment, materials, or supplies to complete the work, unless otherwise stated.
3. Test and inspect as required by this specification.
4. Furnish the data required by this specification to document that required tests and inspections have been performed.
5. Package, ship, and deliver gloveboxes.
6. Provide LANL full access to the facility for performing random or scheduled inspections and/or surveillance of work performed.
7. Provide LANL with a lower tier services plan including the name, address, telephone number, and point of contact for outside services that the supplier intends to use on this project. Identify the specific work requirements of this specification that will be performed by those outside services.
8. Provide a fabrication schedule showing fabrication steps, hold points, tests, and inspections. Provide a revised fabrication schedule after any modification to the contract document, which revises the required delivery date, or when other approved LANL changes otherwise change a scheduled assembly step hold point, test, or inspections.
9. Provide seven (7) working days advance notice of a hold point activity requiring LANL witness or inspection.

D. Reference Contract Drawings

1. Attachment 1 of this section provides a list of LANL Glovebox Drawings often referenced by contract drawings provided to the supplier for fabrication of gloveboxes.

Edit applicable related sections defined below to meet the project requirements associated with the glovebox to be fabricated.

1.3 RELATED SECTIONS

- A. Section 01 1116: Work by Owner
- B. Section 01 3300: Submittal Procedures
- C. Section 01 6000: Product Requirements
- D. Section 01 2500: Substitution Procedures
- E. Section 01 7700: Closeout Procedures

- F. Section 01 7839: Project Record Documents
- G. Section 11 5311.08: Glovebox Fabrication
- H. Section 11 5311.14: Glovebox Gloves
- I. Section 11 5311.16: Glovebox Feedthroughs, Hermetically-Sealed
- J. Section 11 5311.18: Glovebox Atmosphere Regenerable Purification Systems
- K. Section 11 5311.12: Glovebox Installation
- L. Section 13 4800: Sound, Vibration and Seismic Control
- M. Section 11 5311.17: Glovebox Instrumentation
- N. Section 22 0554: Identification for Plumbing, HVAC, and Fire Piping and Equipment
- O. Section 23 4133: High Efficiency Particulate Filtration
- P. Section 23 3225: Bag-in Bag-out Housing
- Q. Section 23 0593: Testing, Adjusting and Balancing for HVAC
- R. Section 26 0553: Raceway and Boxes for Electrical Systems
- S. Section 26 0519: Low Voltage Electrical Power Conductors and Cables
- T. Section 26 0533: Raceway and Boxes for electrical Systems
- U. Section 26 0526: Grounding and Bonding for Electrical Systems
- V. Section 26 5100: Interior Lighting
- W. Section 40 0511: Compression Fittings on Copper and Stainless Steel Tubing
- X. Section 40 0513: Common Work Results for Process Piping [future]]

1.4 DEFINITIONS

- A. Access Panel: A removable and resealable panel used for interior access.
- B. Airlock: A transition enclosure for material movement into and out of the glovebox that maintains the primary confinement. The term “transfer airlock” is sometimes used interchangeably with airlock. An airlock is sometimes purged with inert gasses.
- C. Certificate of Conformance (CoC): A supplier’s certification that is traceable to the shipment, the items, or materials and states that the materials conform in all respects with the purchase order requirements. This certificate is signed or otherwise authenticated by the supplier’s authorized representative. The CoC is

signed and authenticated by the responsible person within the manufacturing organization and certifies the conformance of all items shipped to purchase order requirements [NMT: refer to NMT-AP-011].

- D. Glovebox: A controlled environment enclosure providing primary confinement from the work area. Operations inside gloveboxes are performed through sealed glove openings for the protection of the worker, the environment, and/or the process.
- E. Hood: An enclosure similar to a chemical fume hood. A non-isolated enclosure for controlled access to a glovebox that may also be used independently as a stand-alone unit or in a line with other hoods. Confinement is achieved through airflow in a hood. Hoods can also be used for low-level analytical chemistry operations. Can also be referred to as an Open-Front Glovebox, Introductory Glovebox, or Radio-Benches. For the purposes of this specification only, the term Hood will be used interchangeably with Open-Front Glovebox, Introductory Glovebox, and Radio-Bench.
- F. Primary Confinement: The barrier (structure) that is directly in contact with bulk radioactive material. The barrier, that if breached exposes the bulk radioactive material. Primary confinement is pipes and vessels in a tritium system. Primary confinement in an SNM process may be process piping and vessels or may be the glovebox when solids are exposed in machining and handling processes.
- G. Secondary Confinement: Secondary confinement is a structure erected around primary confinement for the purposes of creating a barrier to block migration of unanticipated and anticipated breaches of the primary confinement. Gloveboxes are secondary confinement in a tritium system or a wet chemistry SNM process where they isolate releases of radioactive materials when the process piping must be opened.
- H. Shielded Gloveboxes: A shielded glovebox is a glovebox provided with radiation shielding. Depending on process conditions, certain gloveboxes may be shielded by the addition of gamma shielding and/or neutron shielding covering the front, sides, back, and bottom of the glovebox as required. This shielding may be covered by stainless steel.
- I. Supplier: A contractor providing services to LANL.

1.5 ACRONYMS

- A. AGS: American Glovebox Society.
- B. AISI: American Iron and Steel Institute
- C. ANSI: American National Standards Institute
- D. ASME: American Society of Mechanical Engineers
- E. ASNT: American Society of Nondestructive Testing

- F. ASTM: American Society for Testing and Materials
- G. AWS: American Welding Society
- H. B&PVC: Boiler and Pressure Vessel Code
- I. CD: Capacitive Discharge
- J. CFR: Code of Federal Regulation
- K. CMTR: Certified Material Test Report
- L. CoC: Certificate of Conformance
- M. CRL: Central Research Laboratories
- N. DOE: Department of Energy
- O. LANL: Los Alamos National Laboratory
- P. LIR: Laboratory Implementation Requirement
- Q. NDE: Nondestructive Examination
- R. NQA: Nuclear Quality Assurance
- S. PQR: (Welding) Procedure Qualification Record
- T. QA: Quality Assurance
- U. QC: Quality Control
- V. SAE: Society of Automotive Engineers
- W. SDDR: Supplier Deviation Disposition Request
- X. SSPC: Steel Structures Painting Council
- Y. UL: Underwriters Laboratories
- Z. WPS: Welding Procedure Specification
- AA. WPQ: Welder Performance Qualification Record

1.6 REGULATORY REQUIREMENTS

Codes, specifications, and standards referred to by number or title form a part of this specification to the extent required by the following references and others that may exist in this document. Use codes, specifications, and standards referenced below of the latest revision at the time of award of contract, unless otherwise stated below.

- A. 10 CFR 830.122: Quality Assurance Criteria

- B. AGS-G001: Guideline for Gloveboxes
- C. ASME B18.2.1: Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws
- D. ASME Boiler and Pressure Vessel Code (B&PVC), Section II – Part C: Material Specifications – Welding Rods, Electrodes, and Filler Metals
- E. ASME B&PVC, Section V: Nondestructive Examination
- F. ASME B&PVC, Section VIII – Division I, Pressure Vessels
- G. ASME B&PVC, Section IX: Welding and Brazing Qualifications
- H. ASME NQA-1-1997: QA Program Requirements for Nuclear Facilities
- I. ASNT SNT-TC-1A: Recommended Practice
- J. ASTM A36: Structural Steel
- K. ASTM A182: Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves, and Parts for High-Temperature Service
- L. ASTM A193: Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
- M. ASTM A194: Carbon and Alloy Nuts for Bolts for High-Pressure and High-Temperature Service
- N. ASTM A240: Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
- O. ASTM A276: Stainless and Heat-Resisting Steel Bars and Shapes
- P. ASTM A307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- Q. ASTM A325: High-Strength Bolts for Structural Joints
- R. ASTM A354: Quenched and Tempered Alloy-Steel Bolts, Studs, and Other Externally Threaded Fasteners
- S. ASTM A479: Stainless and Heat-Resisting Steel Bars and Shapes for use in Boilers and other Pressure Vessels
- T. ASTM A480: Flat Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
- U. ASTM A511: Seamless Stainless Steel Mechanical Tubing
- V. ASTM A554: Welded Stainless Steel Mechanical Tubing
- W. ASTM A563A: Carbon and Alloy Steel Nuts

- X. ASTM A572: High-Strength Low-Alloy Columbium-Vanadium Steels
- Y. ASTM B749: Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products
- Z. ASTM B209: Aluminum and Aluminum-Alloy Sheet and Plate
- AA. ASTM C1036: Flat Glass
- BB. ASTM C1172: Laminated Architectural Flat Glass
- CC. ASTM E499: Methods of Testing for Leaks Using the Mass Spectrometer Leak Detector in the Detector Probe Mode
- DD. ASTM F593: Stainless Steel Bolts, Hex Cap Screws, and Studs
- EE. ASTM F594: Stainless Steel Nuts
- FF. AWS A2.4: Symbols for Welding, Brazing and Nondestructive Examination
- GG. AWS D1.1: Structural Welding Code Steel
- HH. LANL LIR 230-01-02: Management Level Determination
- II. SAE J429: Mechanical and Material Requirements for Externally Threaded Fasteners.
- JJ. SSPC SP-1: Solvent Cleaning
- KK. SSPC SP-6: Commercial Blast Cleaning
- LL. UL: Underwriters Laboratories

The author is required to define many aspects of the glovebox design. Designate management level of the glovebox in accordance with LIR 230-01-02, Management Level Determination. Following the designation of management level, interpret the requirements for the designated management level and define those requirements in this specification.

1.7 LANL FURNISHED AND INSTALLED EQUIPMENT

- A. Refer to Section 01 1116.

1.8 SUBMITTALS

- A. Provide reference to LANL Contract Number, Glovebox Number, Glovebox Title, and Drawing Number on correspondence.
- B. Provide submittals listed in Attachment 3 and in accordance with the requirements of Section 01 3300.

Determine whether the kick-off meeting is required and the appropriate time for the kick-off meeting.

1.9 KICK-OFF MEETING

- A. Hold a half-day kick-off meeting at Los Alamos, NM within 10 working days after award of the contract. The kick-off meeting may be waived at the discretion of LANL. Provide technical documentation required for submittal at the kick-off meeting conference even if a kick-off meeting is not held. Review the following at the kick-off meeting:
 - 1. Contract document provisions.
 - 2. Technical specifications.
 - 3. Contract drawings.
 - 4. Fabrication schedule.
 - 5. Supplier's lower tier services plan.
 - 6. Supplier's QA manual.
 - 7. Required procedures.
 - 8. Welding and NDE Personnel List.
 - 9. Philosophy of shop traveler.

Determine and specify schedule requirements including required delivery date if critical.

1.10 SCHEDULE

- A. Provide a fabrication schedule showing fabrication steps, hold points, tests, and inspections. Provide fabrication schedule to LANL, for approval, at the kick-off meeting.
- B. Provide a revised fabrication schedule for LANL approval within seven (7) working days of a modification to the contract document, which revises the required delivery date, or when other approved LANL changes otherwise change a schedule assembly step hold point, test, or inspection.
- C. Provide seven (7) working days advance notice of a hold point activity requiring LANL witness or inspection.

Determine whether a shop traveler is required for submittal with the fabrication of the glovebox.

1.11 SHOP TRAVELER

- A. Use a shop traveler system and the contract drawings to transform the technical requirements of this specification into specific work instructions, which indicate the fabrication and inspection sequence and identify hold points.
- B. Provide a shop traveler procedure. Include in the procedure a description of the preparation, use, and monitoring of the shop traveler. Also include in-process tracking of items, processes, hold points, and inspections. Submit for approval, the shop traveler procedure prior to fabrication. Provide the shop traveler form as an attachment to the shop traveler procedure.
- C. After work is finished, submit the completed shop traveler form as part of the QA Document Package in accordance with Section 01 3300.

Determine and specify any additional fabrication hold points required on a project-by-project basis.

1.12 FABRICATION HOLD POINTS

- A. Hold points are required during the fabrication process to allow inspection, verification, or approval by LANL before the supplier does further work. Identify hold points on the shop traveler and make provision for LANL signoff. The hold points are:
 - 1. Weld Fit-up Inspection
 - 2. Lead Fit-up Inspection (Lead shielded gloveboxes only)
 - 3. Shop Acceptance Testing and Inspection
- B. For hold points requiring witness or inspection at the supplier's facility, provide seven (7) working days advance written notification to LANL so that a LANL representative may be present at the supplier's shop to witness the activity. At LANL's discretion, photographic records of the fit-ups may be substituted for physical inspections.
- C. Inspection Data Sheet-Glovebox: The LANL representative is required to log an inspection report for each activity. The Inspection Data Sheet is provided as Attachment 5. The LANL representative will document inspection conformance and/or exceptions and provide approval to proceed with fabrication. Submit the completed Inspection Data Sheet form as part of the QA Document Package in accordance with Section 01 3300.

The following quality assurance requirements are consistent with fabrication of a ML-1 and ML-2 glovebox. Where other quality assurance and quality control requirements are needed, modify the following section accordingly. For instance, the supplier may also apply a QA program in accordance with basic requirements of 10 CFR 830.122. Add requirements for QA Programs compliant with 10 CFR 830.122 to the specification as necessary.

1.13 QUALITY ASSURANCE/QUALITY CONTROL

- A. As used in this document, QA is intended to control a combination of materials, preparation, fabrication, inspection, testing, cleaning, packaging, and shipping to be done to ensure the protection of an acceptable finished product. Maintain a QA program in accordance with certain Basic Requirements of ASME NQA-1, QA Program Requirements for Nuclear Facilities.
- B. QA Manual: Submit an uncontrolled copy of the supplier's QA Manual for fabrication at the kick-off meeting for approval. Address the following NQA-1, Basic Requirements in the QA Manual:
 - 1. Basic Requirement 1: Organization
 - 2. Basic Requirement 2: QA Program
 - 3. Basic Requirement 4: Procurement Document Control
 - 4. Basic Requirement 5: Instructions
 - 5. Basic Requirement 6: Document Control
 - 6. Basic Requirement 7: Control of Purchased Items and Services
 - 7. Basic Requirement 8: Identification and Control of Items
 - 8. Basic Requirement 9: Control of Processes
 - 9. Basic Requirement 10: Inspection
 - 10. Basic Requirement 11: Test Control
 - 11. Basic Requirement 12: Control of Measuring and Test Equipment
 - 12. Basic Requirement 13: Handling, Storage, and Shipping
 - 13. Basic Requirement 14: Inspection, Test, and Operating Status
 - 14. Basic Requirement 16: Corrective Action
 - 15. Basic Requirement 17: QA Records
 - 16. Basic Requirement 18: Audits

- C. It is acceptable to reference the procedures in the following sections as a part of the Quality Assurance program.
- D. Fabrication and Quality Control (QC) Procedures: The list of procedures to be followed and their submittal schedule is contained in Section 01 3300. LANL in cases may waive submittal, where procedures have previously been evaluated. Maintain a list of quality procedures, including the revision number or date of approval.
- E. Personnel Certifications: Ensure that supplier personnel assigned to glovebox fabrication including welding, assembly, testing, and inspections are fully qualified to perform their respective job functions. Section 01 3300 contains the list of required personnel certifications, and their schedule for submittal.
- F. Test Reports: Ensure that tests performed in support of the glovebox fabrication, welding, assembly, testing, and inspection are fully documented. Section 01 3300 contains the list of test reports, and their schedule for submittal.
- G. Material Certifications: Provide material certifications including legible copies of mill test reports indicating chemical analysis, physical test data, and heat number. Section 01 3300 contains the list of material certifications, and their schedule for submittal.
- H. As-Built Drawings: Submit as-built drawings as described in § 2.3 of this specification, to reflect modifications or deviations to the contract drawings. In addition, use these drawings to indicate weld locations and material identification and to document the dimensional verification performed by the supplier.
- I. QA Document Package: Submit documents identified in this specification as a part of the QA Document Package. Complete three bound or stapled document packages containing these documents required "with shipment" in accordance with Section 01 3300. Mail one package to LANL and provide the other two packages with the glovebox shipping crate.

1.14 MATERIAL CONTROL

- A. Material Control Procedure
 - 1. Submit to LANL, for approval, a material control procedure to be used in the execution of the work. Describe the control methods and traceability documentation in the procedure used by the supplier to handle and monitor the use of controlled materials, such as stainless steel and welding filler rod.
 - 2. Address procurement controls, segregation of materials, and traceability of materials from receipt at the shop through processing and final assembly in the procedure. Submit this procedure to LANL for engineering review, comment, and approval, prior to fabrication.

- B. Heat Numbers: Note heat numbers on weld maps using low-chloride content marking pens on each piece part and the material identifications transferred to the as-built drawings as described in § 2.3.

1.15 EXCEPTIONS, DEVIATIONS, AND CONFLICTS

- A. Submit a written request to LANL for any proposed technical changes, exceptions, and/or deviations to this specification or the contract drawings. Submit proposed changes that affect cost or schedule in accordance with the provisions of the contract document.
- B. Supplier Deviation Disposition Request (SDDR): Provide proposed change information using the SDDR form provided as Attachment 2. Consecutively number SDDR's and submit by facsimile for expediency with a record copy to follow by mail. Submit one (1) copy the LANL Contract Administrator and a second to the LANL Contract Administrator's Technical Representative. Do not implement proposed changes, exceptions, or deviations until the LANL Contract Administrator provides written approval by means of the SDDR form.
- C. Conflicts: Notify LANL in the event of conflicts amongst the specifications, drawings, and/or the manufacturer's recommended processes or instructions. Provide notification of a conflict immediately following its discovery. Provide notification in written form, or via phone call followed by facsimile.

Evaluate and determine whether proposed substitutions for "or equal" products are adequate for the intended purpose.

D. Substitutions

1. Request approval for substitutions by submitting an SDDR form, where this specification or the contract drawings contain a "brand name or equal" description. Submit one (1) copy to the LANL Contract Administrator and a second to the LANL Contract Administrator's Technical Representative.
2. If the supplier proposes to provide an equal to the listed brand names, the evaluation and the determination as to the quality of the proposed product will be the decision of LANL and will be based on information furnished by the supplier.
3. There will be no responsibility by LANL for locating or securing any information to evaluate and determine the equality of any proposed product. Therefore, ensure that sufficient information and descriptive material are provided such as cuts, illustrations, drawings, or other information to establish clearly and precisely what product the supplier is proposing and demonstrate that the product offered meets the requirements of this specification.

1.16 PACKAGING PREPARATION

- A. Do not perform packaging and shipping of gloveboxes until shop acceptance testing and inspection have been performed and the results approved by LANL. Prepare and package gloveboxes and associated components to prevent damage during shipping and handling. Use particular care to ensure that the surface finishes, cleanliness, dimensional stability, and overall integrity of the gloveboxes achieved during fabrication are not affected during shipment.
- B. Install windows loosely on the glovebox or ship separately. Electrical connector installation is optional, depending upon vulnerability. Seal glovebox openings with temporary covers or other protection to exclude dirt and prevent damage to openings of fittings or sealing surfaces of gasketed openings. Protect mating surfaces with clean plywood or cardboard covers. Use tape consisting of low chloride (250 ppm) content.
- C. If glovebox is fabricated at an elevation different from the elevation indicated in the site conditions section of this specification, provide for a means of pressure relief in the glovebox during shipping. An open service penetration on the glovebox will provide adequate means of pressure relief. Do not seal glovebox during shipping.

1.17 PACKAGING

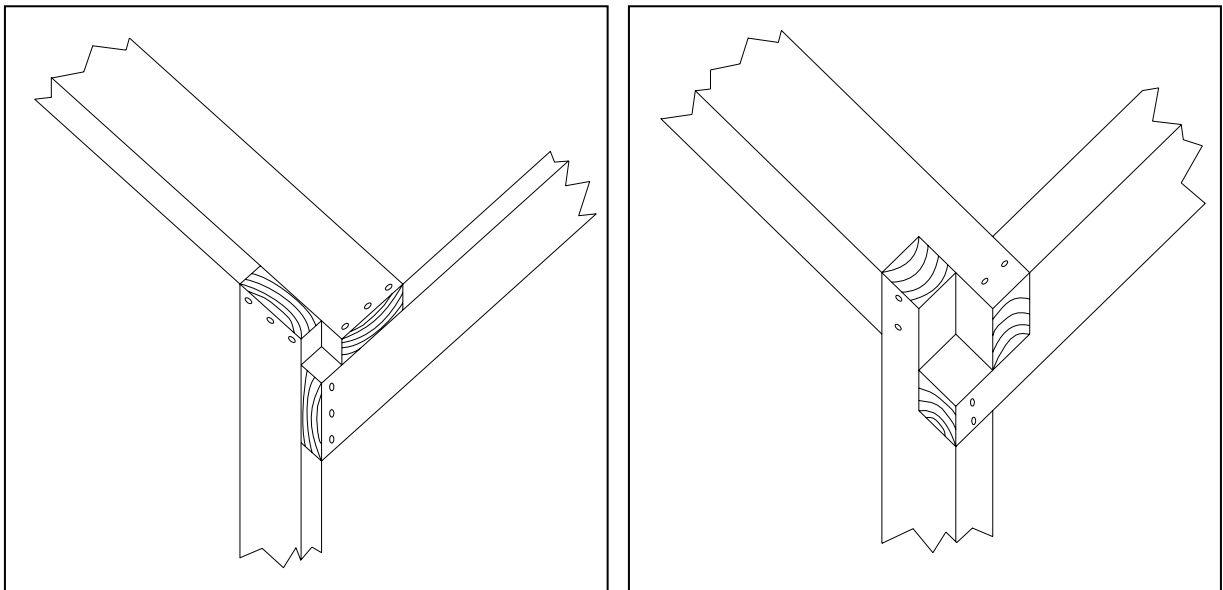
- A. Packaging Procedure: Submit a packaging procedure. This procedure describes the methods, material control, and inspections to be used by the supplier to perform glovebox packaging for shipment. The procedure addresses the covering of glovebox openings, pallet and crate construction, protection of the glovebox sealing surfaces, and marking of the crate. Submit this packaging procedure for approval prior to performing this work.
- B. Pack gloveboxes individually in totally enclosed wooden crates with pallets or provisions for handling by a forklift. Ship gloveboxes as complete assembled units except for support stand legs. Fully welded support stands to be shipped separately from the glovebox shell. If shipping limitations restrict complete assembly shipments, propose a recommended alternative for approval by LANL. Separately pack components or items that may work loose or be lost in transit.
- C. Bag or crate any separate components that are part of the order and mark accordingly to describe or identify the glovebox with which the components are associated. Furnish packing material, weather protection, dunnage, and crating.
- D. Provide desiccant bags inside gloveboxes to prevent condensation build-up during shipping.

1.18 CRATING

- A. Provide lumber seasoned, reasonably sound, and free from cross grain and knots that would interfere with nailing or stapling, or knots that are greater than 1/3 the width of the lumber.

- B. Construct crates with outer framework consisting of upright and horizontal members and with additional diagonal upright and horizontal members where necessary to provide proper strength and rigidity.
- C. Construct crates with three-way lock corners, where members will be joined with nails or staples driven into side grain of joining members. See the following examples of three-way lock corners.
- D. Use double nailing or stapling to fasten joining crate members.
- E. Design and construct crates with transverse cross-members at the base sufficient in strength to protect the underside from damage by mechanical handling equipment.

EXAMPLES OF THREE-WAY LOCK CORNERS



- F. **Crate Marking:** Properly and clearly mark crates on the top and four sides using a stencil. As a minimum, provide information including LANL contract number, glovebox number, and the actual weight of the crate and its contents. Identify each crate or package as a part of the total order, for example "Crate #1 of 5."

1.19 SHIPPING

- A. Provide LANL with a copy of the bill of lading concurrent with the shipment. Properly and clearly describe the shipment on the bills of lading.

 Provide final inspection and acceptance upon receipt of the shipment at Los Alamos. Inspect the shipment as necessary to ensure that received items have not been damaged during shipment and that required items and supporting documentation have been received.

1.20 RECEIVING

- A. Final Inspection and Acceptance: LANL will inspect the shipment as necessary to ensure that received items have not been damaged during shipment and that required items and supporting documentation have been received. The receipt inspection by LANL at Los Alamos constitutes final acceptance.

1.21 WARRANTY

- A. Guarantee the gloveboxes and glovebox equipment at design conditions and warrant that materials and workmanship or apparatus supplied, are in accordance with contract document requirements.

1.22 SITE CONDITIONS

- A. Gloveboxes will be installed at an altitude of 7,500 feet above sea level at Los Alamos National Laboratory, located in Los Alamos County, NM.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01 2500, Substitution Procedures.

An approved vendors list shall be established for glovebox vendors in accordance with the appropriate Quality Assurance Program Plan. Authors shall select vendors from the approved vendors list. An approved list of glovebox suppliers has been established by NMT for gloveboxes used at TA-55 and CMR. This approved list is identified below:

2.2 SUPPLIERS

- A. Companies specializing in manufacturing products specified in this section with suitable documented experience of performing similar work.

1. Absolute Control Systems
5168 Parfet St., Unit G
West Ridge, CO 80033
(303) 420-8922
2. JONA Machining Company
2685 Industrial Lane
Broomfield, CO 80020
(303) 438-1570
3. Premier Technology, Inc.
170 East Siphon Rd.
Pocatello, ID 83202
(208) 238-3036

Determine and specify the type of material to be used for the glovebox shell, glovebox support stand and other appurtenances. Specify material based upon application and compatibility with the process and corrosive environments. (e.g., carbon steel may be used for fabrication of the glovebox support stand in lieu of stainless steel, however, consider decontamination requirements outside of the glovebox. Coat carbon steel support stands with a decontaminable coating.)

2.3 MATERIALS

- A. Provide new materials complying with this specification section and relevant standards
- B. For glovebox shell materials use stainless steel type [304, 304L, 316 or 316L].
- C. Stainless Steel Sheet
 - 1. The phrase "300-series stainless steel" is used throughout this specification section. 300-series stainless steel refers to types 304, 304L, 316, or 316L stainless steel. Type 304L may be substituted for type 304, and type 316L may be substituted for type 316. Do not substitute type 304L or type 316L material when it is specified on the contract drawings. If 300-series stainless steel is specified, one of the four types of stainless steel as previously stated may be used at the discretion of the supplier.
 - 2. Fabricate gloveboxes from 300-series stainless steel, as specified on the contract drawings. Use 7-gauge sheet stock with a No. 2B mill finish on both sides conforming to ASTM A240 and A480 for shell material.
 - 3. Fabricate 16-gauge sheet used to cover the lead sheet on shielded gloveboxes from 300-series stainless steel as specified on the contract drawings. Provide sheet with a No. 2B mill finish on both sides.
 - 4. It is recommended that the supplier purchase stainless steel sheet with a protective coating on both sides to protect the mill finish.
 - 5. Provide to LANL a Certified Material Test Report, as part of the QA Document Package in accordance Section 01 3300.
- D. Stainless Steel Plate
 - 1. Do not use plate stock except where so specified in the contract drawings. When plate stock is required for use as a reinforced floor or as mounting pads for equipment, use the same grade of stainless steel as the shell material per ASTM A240. Polish the plate stock to the surface finish required by § 3.4.

E. Stainless Steel Bars and Shapes

1. Provide structural bars and shapes used in glovebox fabrication in the same grade of stainless steel as the glovebox shell material, meeting the requirements of ASTM A276.
2. Where approved by LANL, equivalent shapes may be fabricated by bending the appropriate sheet or plate stock.

F. Stainless Steel Forgings

1. Provide forged couplings and other forged pieces used in glovebox fabrication as the same grade of stainless steel as the glovebox shell material. Ensure forgings meet the requirements of ASTM A182 or ASTM A479. Castings are not permitted unless specified in the contract drawings. Castings are permitted for 150# rated pipe elbows. Couplings rated for 3000# may be used in lieu of couplings rated for 150# when the couplings are unavailable in the same material as the glovebox shell.

G. Stainless Steel Structural Shapes

1. Provide stainless steel structural shapes including channel, I-beam, and L-angle per the chemical and physical requirements of ASTM A276. Provide CMTR's with structural shapes.

H. Stainless Steel Structural Tubing

1. Ensure square and rectangular tubing used for the support stand meet the chemical and physical requirements of ASTM A554.

I. Carbon Steel

1. Ensure carbon steel for the glovebox support stand conforms to the chemical and physical requirements of ASTM A36, ASTM A572, or A588 standards as specified on the contract drawings.

J. Welding Materials

1. Use filler materials that conform to ASME B&PVC Section II, Part C and as follows:

| <u>Base Material</u> | <u>Filler Material</u> |
|----------------------|------------------------|
| Type 304 SS | ER 308 |
| Type 304L SS | ER 308 L, or ER 347 |
| Type 316 SS | ER 316 |
| Type 316 L SS | ER 316 L |

2. Provide CMTRs or CoCs for welding filler materials used in the fabrication process as part of the QA Document Package in accordance with Section 01 3300.

Determine and specify the appropriate lead thickness in accordance with radiation shielding analyses.

K. Lead

1. Ensure lead used in the fabrication of applicable portions of shielded gloveboxes meets the chemical requirements of ASTM B749. Submit a CMTR or CoC as part of the QA Document Package in accordance with Section 01 3300.

Determine and specify the type of gloveport to use for gloveboxes. Determine whether gloveports will be bolted into the glovebox shell or windows. Determine whether gloveports will be welded into the glovebox shell.

L. Gloveports

1. Use push-through gloveports from Central Research Laboratories (CRL, no substitution) of the round or oval shape for gloveboxes. Provide weld-in or clamp-in gloveports. Fit gloveports with blank plugs.
2. Provide gloveports of the rolled and welded type or CRL push-through type for hoods (no substitution)
3. Provide o-ring materials for bolt-in, push-through gloveports of type [neoprene, buna-N, Viton, silicone].

M. Glovebox Gloves

1. Refer to Section 11 5311.14 – Glovebox Gloves.

Determine and specify type of viewing window material to use for gloveboxes. Note that Lexan® is considered a combustible product and may have an impact on facility combustible loading calculations. Use of Lexan and impact on facility combustible loading shall be considered prior to specification and use for glovebox windows.

N. Windows

1. Provide viewing pane material of [safety glass, leaded safety glass, or polycarbonate resin (Lexan®)]. Provide glass thickness of [1/4-inch, 3/8-inch, 1/2-inch, 5/8-inch].

2. Provide window materials with Certified Material Test Reports (CMTR). Certificates of Conformance (CoC) may be provided in lieu of CMTR's with prior approval from LANL.
 - a. Safety Glass: Provide safety glass with two equal layers of annealed plate joined by a 0.030- to 0.050-inch laminate layer of polyvinylbutyral (PVB). Provide safety glass with a density of 2.5 and a refractive index of 1.52. Provide glass meeting the requirements of ASTM C1036 and ASTM C1172.
 - b. Lead Glass: Use lead impregnated safety glass where approved by LANL for shielding window applications. Coat lead glass with float glass on both sides for protection from scratching and chipping. Lead glass density should not exceed 5.2 to avoid yellowing
 - c. Polycarbonate Resin: Provide fire retardant grade Lexan® with silicate coating (MARGuard).
 - d. Chemically-Strengthened Glass: Provide chemically strengthened, laminated safety plate glass, Toroglass® from Hot Cell Services. Provide plate glass with a density of 2.5 g/cc with an index of refraction of 1.52.
3. Provide window gasket elastomers of black neoprene, with durometer between 40 and 60, shore A.

O. Fasteners

1. Provide fasteners with Certified Material Test Reports (CMTR). Certificates of Conformance (CoC) may be provided in lieu of CMTR's, when CMTR's are not available from the mill or subtier supplier. Where approved by LANL prior to submittal, CoCs may be submitted in lieu of CMTRs.
2. Use UNC-series threads with screws, fasteners and components with mating threads.
3. Provide bolts and cap screws with grade marks.
4. Implement provisions to ensure that materials used or supplied are not counterfeit or of other suspect origin. Pay particular attention to high strength bolting materials (grade 5 and 8 strength) and pipe fittings. Reference Attachment 4 for further guidance on suspect fasteners.
5. Stainless Steel
 - a. Unless otherwise specified on the contract drawings, use stainless steel for nuts and washers used in the glovebox fabrication.
 - b. Use stainless steel fasteners type 304, 304L, 316 or 316L.
 - i. Bolts and Hex Head Cap Screws: ASTM F593, Grade 2A.

- ii. Nuts: ASTM F594, Grade 2B.
 - iii. High Crown Acorn Nuts: AISI 300-series
- c. In the event that fasteners are not readily available meeting the requirements of ASTM F593 and ASTM F594, then fasteners meeting the requirements of ASTM A193 and ASTM A194, respectively may be substituted with prior approval by LANL.
- d. Ensure graded stainless steel fasteners conform to the following standards: ANSI B18.2.1, SAE J429, and ASTM A354.
- 6. Carbon Steel
 - a. Carbon steel bolts per ASTM A307 or A325 and nuts per ASTM A563A. Ensure graded carbon steel fasteners conform to the following standards: ANSI B18.2.1, SAE J429, and ASTM A354.
- 7. Stainless Steel Weld Studs
 - a. Ensure Capacitive Discharge (CD) weld studs welded to the exterior of the glovebox are 300 series stainless steel and meet the chemical requirements of ASTM A276. Ensure weld studs welded to the interior of the glovebox are of the same type stainless steel as the glovebox shell. Provide CoCs with CD weld studs.

P. Electrical Feedthroughs

- 1. Refer to Section 11 5311.16 –Glovebox Feedthroughs, Hermetically-Sealed

Q. Material Transfer Devices

- 1. Provide material transfer devices including [bagports, double-door transfer systems, airlocks, input sphincter, introductory tubes]. Attachment 1 of this section provides design details of some of these material transfer systems.
- 2. Provide double-door transfer systems from Central Research Laboratories. Provide double-door transfer systems of diameter [105 mm, 190 mm, 270 mm, or 350 mm].
- 3. Provide [rolled and welded bagport, or CRL push-through bagport (no substitution)] for use with [30-gallon drums, 55-gallon drums]. Provide rolled and welded bagports in accordance with drawings in Attachment 1.
- 4. Provide airlock of size [XX-inches diameter by XX-inches long]. Provide airlock doors of a [counterbalance style or guillotine style]. Provide a slide tray inside the airlock.

For non-UL rated components, verify the acceptability of the components prior to their use by the supplier.

R. UL-Rated Components

1. Where certified products from Underwriters Laboratories Inc. (UL) or another nationally recognized testing laboratory are available, provide them in lieu of non-certified units. Request approval from LANL for the use of non-UL certified products.

S. Paint

1. Primer

- a. Provide coating materials of the type and color specified on the contract drawings. If unspecified, use a heavy-duty primer (PLASITE® 7102 Heavy Duty Primer by Wisconsin Protective Coatings, or equal). Provide a primer that meets the following requirements:

- i. Minimum dry film thickness of 2.5 mils.
- ii. Heat resistance of 200° F.
- iii. Minimum volume solids content of 43%.

2. Finish

- a. Ensure coating materials are of a type and color specified on the contract drawings. If unspecified, use a cross-linked epoxy-phenolic cured finish with an alkaline curing agent (PLASITE® 7122 by Wisconsin Protective Coatings, or equal). Provide a finish that meets the following requirements:

- i. Pearl gray color.
- ii. Minimum dry film thickness of 5 mils.
- iii. Heat resistance of 200° F.

2.4 AS-BUILT DRAWINGS:

- A. Prepare as-built drawings to reflect the glovebox, as fabricated. Provide as-built drawings consisting of either CADD generated drawings or a redline markup of the fabrication drawings. Submit as-built drawings as part of the QA Document Package in accordance with Section 01330. Document the following in as-built drawings:

1. Modifications and Deviations: Reflect modifications and deviations to the contract drawings that have been approved by LANL and subsequently implemented by the supplier. Do not note dimensional exceptions fabricated within the tolerances of the contract drawings.
2. Weld Locations on Weld Map: Indicate glovebox shell (primary confinement) weld locations on the weld map drawings. Do not depict other welds for stiffeners, stands, attachments, and outer skin. Provide numbering of welds and identification of welders and inspectors.
3. Material Identification: Identify material and heat number of each sheet (or piece – plate) of material used in the glovebox shell weldment on the weld maps.

PART 3 EXECUTION

3.1 GENERAL FABRICATION REQUIREMENTS

- A. Perform cutting with mechanical shop tools, plasma arc, laser, or water jet. Do not use carbon arc or iron powder cutting on stainless steel.
- B. Ensure cut or raw edges are deburred and smooth to the touch.
- C. Ensure shell bends have an inside radius of 5/8 inches with other bends having a minimum inside radius equal to the thickness of material, unless otherwise specified on the contract drawings.
- D. Chase coupling threads with tap after the coupling is welded into place.
- E. Use wire brushes made of stainless steel. Ensure grinding wheels and wire brushes are new or previously used only on stainless steel.
- F. Temporary carbon steel clamps, supports, braces, and fixtures used during fabrication are not be welded directly to, or come into direct contact with, any stainless steel surfaces. Do not use galvanized steel clamps or fixtures.
- G. Clean press brake dies with solvent before use in forming stainless steel materials. Ensure carbon steel parts of the press brake that will come in contact with the stainless steel material are masked or covered to control carbon contamination.
- H. Provide a weld fit-up inspection after the glovebox is formed and tack welded in place but before final welding. This inspection will also include the preliminary dimensional inspection. Provide LANL with a seven (7) working day advance written notice so that a LANL representative may witness the activity.

3.2 DIMENSIONAL CONTROL

- A. Ensure dimensions and tolerances specified on the contract drawings apply to the finished glovebox or component. Indicate compliance with all dimensions by

developing and submitting a Dimensional Control Map. Verify all dimensions on drawings and document measured dimensions on Dimensional Control Map. Also document surface flatness measurement around sealed openings as required in Drawing 26Y-202001. Submit Dimensional Control Map with QA Document Package.

- B. Ensure flatness of the glovebox cutout surfaces is in accordance with drawing 26Y-202001 by:
1. Providing a dimensional inspection report that takes a measurement every 6 inches around the perimeter of the cutouts. This inspection report (flatness grid map) shall be submitted with QA Document Package.
 2. Ensuring the tooling and equipment used for determining surface flatness is verified to be flat within 0.10 of the minimum flatness tolerance defined in the general notes for Gloveboxes, Dryboxes & Introductory Boxes, 26Y-202001.
 3. Submitting to LANL for their review and approval the methodology/procedure to be used to verify cutout surface flatness.

Delete the "Lead Placement" section for non-shielded glovebox specifications.

3.3 LEAD PLACEMENT

- A. Do not glue lead to the glovebox, for shielded gloveboxes requiring lead sheet application.
- B. Ensure there are no gaps in the lead joints. Eliminate gaps by filling with lead wool, fusion welding, or by peening.
- C. Ensure lead applied in multiple layers have staggered joints.
- D. Ensure gaps between lead sheets and structural framing are no larger than 1/8 in.
- E. Pack lead wool into gaps between lead sheets and structural framing. Refer to LANL Drawing 26Y-202001.
- F. Provide LANL with a seven (7) working day advance written notice so that a LANL representative may inspect the lead fit-up, prior to being covered with cladding.

3.4 SURFACE FINISHES

- A. In order to preserve the original finish of the stainless steel sheet material, exercise care to prevent scratching, abrading, nicking, and denting during receiving, storage, fabrication, and handling. Preserve the original protective coating as long as possible.

- B. After fabrication is completed and before testing and inspection, clean, de-scale, and degrease gloveboxes and associated components. Do not paint stainless steel surfaces, interior or exterior, unless specified on the contract drawings.
- C. Surface finishes for gloveboxes are specified below and on the contract drawings.
 - 1. Exterior: Provide exterior surfaces with a 2B sheet finish except welds or damaged surfaces.
 - 2. Interior: Provide interior surfaces with a 2B sheet finish except welds or damaged surfaces.
 - 3. Cladding: Provide cladding surfaces with a 2B sheet finish except welds or damaged surfaces.
 - 4. Welds: Grind and polish welds parallel to the weld to a 32-microinch-roughness height (arithmetical average) finish and blended to the adjacent material. Limit grinding and polishing to the zone disturbed by the welding not exceeding a 2-in. width. Ensure welds covered by shielding are ground so that there is no unevenness in the shielding. Perform liquid penetrant testing on welds covered by shielding.
 - 5. Damaged Surfaces: Polish damaged surfaces to a 32-microinch-roughness height (arithmetical average) finish. Limit the extent of refinishing to the immediate damaged area.
 - 6. Plate: When plate stock is required, polish it to a 32-microinch-roughness height (arithmetical average) finish. Grind plate surfaces to remove pickled finish. Liquid penetrant plate surfaces to locate pits. Repair pits with weld. Grind repair welds and liquid penetrant test again, until pits are removed. Grind and polish repairs to blend with the surrounding material.
 - 7. Appurtenances: Finish appurtenances, such as, but not restricted to doors and door hardware, shelves, brackets, and machined components to a 32-microinch-roughness height (arithmetical average).
 - 8. Openings: Polish a band 1-inch wide around window and panel openings to a 32-microinch finish such that the grain is parallel to the edge of the opening.

3.5 WELDING

- A. Welder Performance Qualification Records (WPQ): Ensure welders, welding operators, and tackers are qualified in accordance with ASME Boiler and Pressure Vessel Code (B&PVC) Section IX. Use welders who have successfully performed welder certification tests in the 3G position. Use welders for welding pipe and tubing who have successfully performed welder certification tests in the 6G position. Provide WPQs for personnel performing welding operations on the gloveboxes. Submit these records to LANL for approval, prior to fabrication.

- B. Welding Procedure Specification (WPS): Use welding procedures specifying standard stainless steel (P8 to P8) WPS per ASME B&PVC Section IX. The range of material thickness covered by the procedure is 3/16 in. For carbon steel, use welding procedures meeting the requirements of ASME B&PVC Section IX or AWS D1.1. Use WPS's that cover the entire range of material thicknesses being welded. Provide a weld procedure that addresses weld repair and welding equipment. Submit the welding procedures to LANL for approval prior to fabrication.
- C. Welding Procedure Qualification Record (PQR): Use welding procedures, including weld repair procedures, meeting the requirements of ASME B&PVC Section IX. This record is a standard PQR for ASME B&PVC, Section IX, which qualifies the supplier's procedure for welding stainless steel (P8 to P8). Submit the PQR to LANL for approval, prior to fabrication.
- D. Welding Processes:
1. Unless otherwise stated on the contract drawings, do not weld carbon steel to stainless steel.
 2. Perform stainless steel welding using GTAW (TIG) methods on stainless steel plate. Optional welding methods using Flux Core Arc Weld, FCAW (MIG), or GTAW (TIG) as the root weld along with Submerged Arc Weld (SAW) to complete the weld are allowed. Submit a welding procedure specification (WPS) to LANL for approval prior to fabrication.
 3. Use shielding gas as specified in the supplier's welding procedure specifications.
- E. Cleaning Before Welding: Prior to welding, interior and exterior surfaces, remove dirt, scale, corrosion, dust, grease, oil, water, or foreign material. Do not use a carbon steel brush for cleaning.
- F. Weld Joint Design:
1. Material 1/8 in. or thinner may be fusion welded without joint spacing between work pieces. Bevel material of 1/8 in. or thinner if required to obtain the specified full penetration weld.
 2. Bevel material with thickness greater than 1/8 in., but less than 1/2 in., to provide a 1/16 in. flat nose with either a 60° V-type or 75° U-type butt joint.
 3. On tee and corner joints or material 1/8-in thick or greater, provide one work piece with a 45° bevel and with a 1/16-in. flat nose.
- G. Butt Welds
1. Provide butt welds with full penetration and with a uniform transition from the joined materials into the weld deposit. Ensure the welds are free of undercutting and un-fused overlap of the weld deposit.

2. Ensure the width of the finish weld layer of butt welds are held to a minimum and do not exceed the width of the weld groove by more than 1/16 inch.

H. Fillet Welds

1. Provide fillet weld surfaces with a uniform transition from the joined material into the weld deposit. Provide welds free of undercutting and unfused overlap of the weld deposit.
2. Provide fillet welds, unless otherwise specified, symmetric with respect to the components they join.
3. Ensure the minimum permissible length of each leg of a fillet weld is equal to the required size of the weld as called out on the procurement drawing, or equal to the thickness of the lighter section being joined if no size is specified. Seal welds are sufficient for sealing with no minimum size requirements.

I. Weld Defects

1. Provide welds free from defects including the following defects and conditions:
 - a. Cracks of any description in the weld or base metal.
 - b. Crater checks or cracks.
 - c. Slag inclusions, oxide inclusions, or gas holes.
 - d. Cold laps in the deposited weld metal.
 - e. Overlap of weld metal on the base metal.
 - f. Undercutting at the edge of the welds. Ensure no part of the finished face of weld in the area of fusion of welded joints lies below the surface of the base metal adjoining the weld.
 - g. Depressions in butt welds below the work piece surface on either side of the welded seam.
 - h. Unfilled weld craters or shrinkage cavities.
 - i. Evidence of damage to the weld metal through oxidation. Oxidation is defined as scaling of the metal that cannot be removed or restored to a bright metal by wire brushing with a stainless steel brush. Heat discoloration or blackening is not considered oxidation.
 - j. Weld spatter.
 - k. Arc burns or scars on the base metal caused by striking or dragging the welded arc across the base metal.

- I. Butt welds with less than 100% penetration. Butt joints normally welded from one side only may be welded from both sides to obtain 100% penetration, provided that no excessive warping occurs in the sections being joined.

Note that welding of glovebox stiffeners to gloveboxes can cause warping of the shell when heat is applied near other welds and openings on the glovebox. Location of stiffeners and sizing of welds for stiffeners needs to be considered during design of the glovebox. Suggest the use of stitch welding to attach stiffeners to glovebox shells.

- m. Intermittent or skip welding, except on exterior stiffeners and unless specified as such on the contract drawings.

J. Stud Welding

1. Use only capacitive discharge (CD) weld studs, unless a stud size larger than 5/16-inch in diameter is specified on the contract drawings.
2. Remove weld spatter.
3. Provide base of male and female studs flush with the plate to which they are welded. Ensure the axis of studs is perpendicular to the plate to which they are welded within 2°.
4. Perform stud gun testing whenever a series of male or female studs are to be welded. Provide a stud gun test procedure before fabrication.
5. Submit test reports for each series of stud welding. Perform the setup and testing as described below:
 - a. Shoot five studs onto a test plate of the same material as the glovebox shell.
 - b. Submit each of the five studs to a torque test or a tensile test.
 - i. Ensure the torque testing apparatus meets the requirements of ASME B&PVC Section IX, paragraph QW-466.5. Provide tensile testing apparatus in accordance with ASME B&PVC Section IX, paragraph QW-466.6.
 - ii. Ensure the acceptance criteria are as specified in ASME B&PVC Section IX, paragraph QW-192.3.
 - iii. If female studs are to be tested, determine the stud size by the nominal thread size and not the diameter or base size.

K. Stud Test Reports

1. Provide test reports for each series of stud welding operations. Ensure these tests comply with the supplier's stud test procedure. Include the following information in the test reports:
 - a. Glovebox identification.
 - b. Date of test.
 - c. Name and signature of test operator.
 - d. Stud gun make, model and settings.
 - e. Torque values at failure or tensile values at failure.
 - f. Failure mode of each of five test studs.

3.6 STAINLESS STEEL CUTTING

- A. Air arc cutting of stainless steel is not permitted.
- B. If plasma cutting is used, grind cut surfaces to remove fused surface.
- C. If stainless steel is nibbled, grind points
- D. Shearing of material is acceptable
- E. Laser or water jet cutting preferred.

3.7 CHLORIDE CONTENT CONTROL

- A. Exercise control during stages of fabrication to minimize exposure of stainless steel to contaminants, in particular any chloride that might cause stress-corrosion cracking.
- B. Avoid chloride-bearing compounds; however, if used, remove them completely by thorough cleaning. Use compounds, liquids, or markers that come into contact with stainless steel surfaces with no more than 250 ppm by weight chloride.
- C. Submit Material Safety Data Sheets or independent lab test reports showing chloride content as part of the QA Document Package in accordance with Section 01 3300 for cleaning solvents, tape adhesive, and marking pens.

3.8 PAINTING

- A. Scope: Paint carbon steel in accordance with this specification and as required by the contract drawings. Do not paint stainless steel components.

B. Surface Preparation

1. Clean and properly prepare surfaces to be coated before any coating is applied. Prevent rusting and/or contamination of cleaned or primed surfaces. Coat the cleaned surfaces the same day cleaning is done and before detrimental corrosion or recontamination occurs. Remove oil, grease, and other contaminants by solvent cleaning in accordance with SSPC SP-1 before any mechanical cleaning.
2. Use abrasives for blast cleaning that are clean and dry. Select abrasives to provide a proper surface profile for the subsequent priming materials. Ensure air pressure supply lines for blasting have effective and proper moisture and oil trap filter devices. Perform blast cleaning in accordance with SSPC SP-6.

C. Application

1. Apply paint to dry, clean, adequately prepared surfaces, in accordance with manufacturer's instructions. Properly cure each coat of paint according to manufacturer's instructions before applying additional coats.
2. Ensure paint containers remain closed until required for use. Mix paint before use in accordance with manufacturer's instructions. Provide agitation during application where specified by the manufacturer.
3. If the total dry film thickness is not obtained in one coat, apply additional coats until the specified thickness is provided.
4. Apply coats in such a manner as to produce a film of uniform smoothness. Pay special attention to crevices, weld lines, bolt heads, corners, and edges to obtain the required thickness.
5. Follow the manufacturer's instructions for thinning, mixing, handling, and applying the products as part of these specifications.

Determine and specify appropriate information for filling in glovebox labels.

3.9 LABELING

- A. Attach an identification nameplate to each glovebox with the glovebox number and procurement drawing number on the first line and the grade of stainless steel and the weight of the glovebox on a second line as shown in the example below.

| | |
|-------------|------------|
| 2001-GB-100 | 55Y-999999 |
| 304L | 1200 LB |

| |
|-----------------------------|
| Date Fabricated: XX/XX/XXXX |
|-----------------------------|

- B. Provide nameplate manufactured from 16-gauge stainless steel of the same grade as the glovebox shell. Provide nameplate with dimensions of 2-in. high and 5.5-in. long, fusion welded to the exterior of the glovebox. Etch or engrave lettering into the nameplate with 3/8-in. high letters and numbers. Place the nameplate at the lower right corner of the front of the glovebox if possible.
- C. A supplier identification nameplate may be attached to the glovebox above the welded nameplate. Ensure the supplier nameplate does not exceed eight (8) square inches.

3.10 ASSEMBLY

A. Conditions

1. Assemble gloveboxes in a clean, dust-free area of the supplier's shop.
2. Assemble multiple adjoining gloveboxes together in an upright position on a level surface.
3. Check to ensure the entire length and height of the gloveboxes are straight and plumb in accordance with the contract drawings.

B. Support Stand

1. Bolt the support stand frame to the glovebox to stabilize the glovebox structure before shop acceptance testing.
2. Completely fabricate, assemble, inspect, and paint the support stand before attachment to the glovebox. For support stands requiring field welds, do not paint support stand. Do not paint stainless steel support stands.
3. Keep support stand attached to the glovebox for subsequent fabrication operations, inspections, tests, packaging, and shipping.
4. The support stand or support stand legs, after being attached for verification to dimensions and tolerances specified by contract drawings, may be removed during glovebox shipping.
5. Use the support stand frame as a template for determining stud location on the glovebox.

3.11 CLEANING

A. Procedure

1. Submit, for review and approval, a cleaning procedure describing the methods, materials, controls, and inspections to be used to perform glovebox-cleaning operations.
2. Provide procedures that address cleaning glovebox surfaces to remove dirt, oils, and marking pen ink. Provide procedure that also includes a specification of the solvents and/or detergents that will be used.
3. Clean both interior and exterior surfaces by removing weld spatter, oil, grease, markings, from pens and dyes, shop soil, and visible rust. Use cleaning methods that do not introduce iron or chloride contamination. Methods may include cleaning by hot water spray or solvent wiping. Submit the procedure to LANL for approval, prior to fabrication.
4. Ensure the cleanliness of the glovebox meets the approval of LANL at the time of the final inspection.

B. Detergent

1. If a detergent is needed to ensure thorough cleaning, use a detergent that is low in chloride. Use fresh water for final wash and rinse. Ensure the detergent, wash, and rinse contains less than 250-ppm chlorides. After the water rinse, dry inside surfaces use heat, lint-free cloth, or other means to ensure cleanliness. If heat is used for drying, ensure the final rinse water is fully softened, low chloride water with less than 250-ppm chloride.

When the glovebox will be subject to live loads such as monorails or hoists, establish additional testing and inspection requirements to verify structural/confinement integrity of the glovebox under all live loads and dead loads (pressure differentials during helium leak testing only test one specific dead load).

3.12 SHOP ACCEPTANCE TESTS

A. Perform the following:

1. Perform helium leak testing required by this specification.
2. Document torque of all fasteners on a torque map prior to performance of helium leak testing. Indicate on the torque map the location of fasteners on the glovebox, torque applied to each fastener, and the calibration data for the torque wrench. Provide the torque map as part of the QA Document Package.
3. Perform non-destructive examination including liquid penetrant testing where required by this specification.

4. Perform dimensional inspection (overall dimensions only) required by this specification.
5. Perform surface finish inspection required by this specification.
6. Perform additional tests and inspection required by this specification.
7. Provide the test location, equipment, and instrumentation of certified accuracy and any supplementary temporary connections and auxiliary parts necessary to fully execute the tests.
8. Provide test personnel qualified to conduct, record, and verify test results.
9. Provide LANL with a seven (7) working day advance written notice of shop acceptance tests.
10. Submit the test results as part of the QA Document Package in accordance with Section 01330.

3.13 NON-DESTRUCTIVE EXAMINATIONS PERSONNEL (NDE) CERTIFICATIONS

- A. Provide NDE personnel performing leak testing and liquid penetrant testing operations certified in accordance with the requirements of ASNT SNT-TC-1A.
- B. Unless witnessed by LANL, provide test reports with signatures by personnel who either performed or witnessed the test and who hold either Level II or Level III certification.
- C. Provide NDE certifications for personnel performing or witnessing the following non-destructive testing inspections:
 1. Helium Leak Test
 2. Liquid Penetrant Test
- D. Submit the NDE certifications for test personnel for approval, prior to testing.

3.14 HELIUM LEAK TEST

- A. Perform a helium leak test on gloveboxes, with the exception of open front boxes. Perform preliminary leak tests and repair welding prior to the shop acceptance test. Perform the final leak test as the shop acceptance test, witnessed by LANL's representative. Perform the leak tests in accordance with ASTM E498 or ASTM E499.
- B. Procedure
 1. Submit a leak test procedure to LANL for approval, prior to testing. Include in the procedure requirements set forth in this specification
 2. Describe the methods, materials, controls, and inspections used to blank off glovebox openings in the procedure. The requirements for creating a

helium atmosphere within the glovebox and how leak detection operations are accomplished are described in this procedure. Document purge method with calculation or use of oxygen monitoring.

3. Test report forms are also a part of this procedure.
- C. Assembly: Assemble the glovebox as much as practical. Provide a glovebox assembly including windows, supplied connectors, and filter housings, but not gloves. Seal openings in the glovebox shell such as gloveports and connecting rings externally with gasketed blank-off plates. Provide blank-off plates and test coverings for openings.
- D. Pressure: Perform testing at a test pressure of 4 in. of water gauge pressure. To prevent pressurization above 6 in. of water gauge pressure, protect the glovebox during the test using a pressure relief device.
- E. Atmosphere
 1. Provide atmosphere within the glovebox during testing with at least 90% helium. Establish the required atmosphere by using either of the following methods:
 2. Purging Method: Connect a helium gas supply to a penetration in the top of the glovebox. A penetration panel coupling may be used or a fitting may be placed in a window blank-off plate. Locate a vent near the bottom of the glovebox. Flow gas from the top to the bottom of the glovebox. Relate the purge flow and time by the following equation,
$$T = 2.3 V/Q,$$
where T is the time required for the purge, Q is the helium flow rate, and V is the glovebox volume.
 3. Balloon Method: Place a weather balloon or plastic bag in the glovebox and fill it with helium until it expands to completely fill the glovebox. Release the contents of the balloon by reaching through a glove on the glovebox.
- F. Calibration: Use leak detector that has been previously calibrated within the last 12 months against a National Institute of Standards and Technology standard leak. Use a calibrated standard leak rate between 10^{-6} and 10^{-7} standard cc/sec.
- G. Leak Detector Probe: Move the leak detector probe along accessible joints and welds no faster than 24 in. per minute. Locate and repair any detectable leak (at the range of 10^{-6} to 10^{-7} standard cc/sec) in a weld or coupling plug. Rework and repair leaks until leaks are eliminated.
- H. Shielded Gloveboxes: Test lead shielded gloveboxes for leakage into the shielding jacket by probing the gaps around the gloveports with the leak detector. Check neutron shielded gloveboxes at the fill port for helium. If helium is present, locate and repair the leaks in the shell seams.

- I. Reports: Provide helium leak test reports for each glovebox tested other than open front boxes. Submit final leak test reports as part of the QA Document Package in accordance with Section 01 3300. Include the following information in the test report:
 1. Glovebox identification.
 2. Date of test.
 3. Name and signature of the test operator.
 4. Make and model of test equipment.
 5. Calibrated leak data.
 6. Calibration data if detectors do not have direct leak indication.
 7. Signature of witness.

3.15 WELD INSPECTION

- A. Visually inspect welds at the supplier's shop during shop acceptance tests. Perform liquid penetrant testing on primary confinement interior welds and any welds so specified on the contract drawings in accordance with ASME B&PVC, Section V.
- B. Perform liquid penetrant testing after grinding and polishing operations. Repair and re-test detected defects. Submit a liquid penetrant test procedure for approval prior to performing the work. Include test report forms as a part of this procedure. Submit the final liquid penetrant test reports as part of the QA Document Package in accordance Section 01 3300.
- C. Liquid Penetrant Test Reports: Provide liquid penetrant test reports for liquid penetrant inspection of welds or polished plate as required by the contract drawings and this specification. Include the following information in the test report:
 1. Glovebox identification.
 2. Date of test.
 3. Name and signature of the certified test operator.
 4. Location and description of indications.
 5. Description of repairs and retest.
 6. Signature of witness.

3.16 DIMENSIONAL INSPECTION

- A. Perform dimensional inspection on the glovebox with a LANL witness present. Verify that the fabricated glovebox is within the overall dimensions and tolerances required by this specification and as shown on the contract drawings.
- B. Use the as-built drawings to document the dimensional inspection as required by § 2.3.

Witness the surface finish inspection on gloveboxes at the supplier's shop prior to shipment to the LANL site.

3.17 SURFACE FINISH INSPECTION

- A. Perform a surface finish inspection on gloveboxes to verify conformance of surface finishes to the requirements stated in § 3.4. Perform inspection with a LANL representative present to witness the inspection. Use a Surface Roughness Analyzer at random places for inspection of the weld and damaged areas. Polish scratches and imperfections detectable by touch.

END OF SECTION

Do not delete the following reference information.

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 11 5311.10 Rev. 0, dated January 6, 2006.

Section 11 5311.10 - Attachment 1
Glovebox Drawing List

| Drawing # | Drawing Title |
|------------------|--|
| 26Y-202001 | General Notes |
| 26Y-202002 | Lead Shielding & Cladding for Zippered and Bolted Gloveboxes |
| 26Y-202005 | Lead Glass Shields for Zippered and Bolted Windows |
| 26Y-202006 | Zippered Window Assembly |
| 26Y-202008 | Bolted Window Assembly |
| 26Y-202010 | Shell Penetrations |
| 26Y-202013 | Typical Gloveport Ring |
| 26Y-202014 | Bolted Service Panel Assemblies |
| 26Y-202015 | Top Access Panel Assembly |
| 26Y-202018 | Bag Ring Assemblies |
| 26Y-202019 | Removable Shelf Assembly |
| 26Y-202021 | Cooling Well Assembly |
| 26Y-202022 | Resistance Furnace Well |
| 26Y-202023 | 14" Dia. Airlock Assembly |
| 26Y-202024 | Standard Airlock Slide Tray Assembly |
| 26Y-202026 | Connector Ring Closure Cap Assy & Connector Assy |
| 26Y-202031 | 14" Dia. Welded Connecting Ring Assembly |
| 26Y-202032 | Sample Taking Port Assembly |
| 26Y-202034 | Reagent Transfer Device Assembly |
| 26Y-202035 | Introductory Tube Assembly |
| 26Y-202039 | 16" Square Connector Assembly |
| 26Y-202046 | Air Cylinder Mounting Assembly |
| 26Y-202047 | Air Operated Vertical Sliding Door Assembly |
| 26Y-202048 | 14" Dia. Opening Counterbalanced Door Assembly 151 R/L |
| 26Y-202049 | 16" Square Airlock Sliding Door--Hydraulic |
| 26Y-202050 | 14" Dia. Opening Air Operated Vertical Sliding Door Assy |
| 26Y-202052 | Introductory Boxes and Hoods Exhaust Transition Piece |
| 26Y-202053 | Introductory Boxes and Hoods Upper & Lower Door Assy's |
| 26Y-202057 | 8" Dia. Exhaust (HEPA) Filter Assembly |
| 26Y-202059 | 8" Filter Housing Assembly |
| 26Y-202060 | Pressure Relief Device 161 Assembly |
| 26Y-202066 | Std. Hi-Vac System Diffusion Pump Mounting Flange Assy |
| 26Y-202067 | Dutchman Assembly |
| 26Y-202075 | Tunnel Dropbox Transition with Firedoor Assy (2 dr) |
| 26Y-202076 | Typical Dropbox Detail Bolt Pattern for Transition |
| 26Y-202077 | Tunnel Dropbox Transition with Firedoor Assy 167 (1 dr) |
| 26Y-202121 | 2 x 3 Glovebox Support Stand Assy |
| 26Y-202122 | 2 x 2 Glovebox Support Stand Assy |

| Drawing # | Drawing Title |
|------------------|--|
| 26Y-202123 | 1 x 3 Glovebox Support Stand Assy |
| 26Y-202124 | 1 x 2 Glovebox Support Stand Assy |
| 26Y-202125 | 1 x 1 Glovebox Support Stand Assy |
| 26Y-202130 | 12" Dia. Exhaust (HEPA) Filter Assembly |
| 26Y-202131 | Neutron Shielded Glovebox Details |
| 26Y-202150 | O-Ring Gasket Seal Tubing to Valve Joint |
| 26Y-202151 | 3" and 2 1/4" I.D. Damper Assembly |
| 26Y-202152 | 4" In-Line Filter Holding Bracket |
| 26Y-202153 | Open-Front Glovebox 7 1/2" Sash Assembly |

Section 11 5311.10 - Attachment 2
Supplier Deviation Disposition Request Form

| SUPPLIER DEVIATION DISPOSITION REQUEST | | |
|---|--|-------------------|
| SDDR# | SUBMITTAL DATE: | DISPOSITION DATE: |
| SUPPLIER | SUPPLIER NAME _____ | |
| | FACILITY ADDRESS _____ | |
| | TELEPHONE # _____ FACSIMILE # _____ | |
| | LANL PURCHASE ORDER/CONTRACT # _____ | |
| | DEVIATION DESCRIPTION: (Proposed exception, deviation or change. Reference existing requirement in specification or drawing. Attach additional sheets as necessary.) _____ _____ _____ | |
| | SUPPLIERS PROPOSED DISPOSITION: _____ _____ _____ | |
| | TECHNICAL JUSTIFICATION FOR DEVIATION: _____ _____ _____ | |
| COST AND SCHEDULE JUSTIFICATION FOR DEVIATION: _____ _____ _____ | | |
| SUPPLIER'S AUTHORIZED REPRESENTATIVE: _____ <div style="display: flex; justify-content: space-between; width: 100%;"> (Name) (Date) </div> | | |

| | | |
|------|---|---------------|
| LANL | LANL DISPOSITION: _____ | |
| | _____ | |
| | _____ | |
| | _____ | |
| | <input type="checkbox"/> APPROVED <input type="checkbox"/> APPROVED AS NOTED <input type="checkbox"/> DISAPPROVED | |
| | CONTRACT ADMINISTRATOR'S TECHNICAL REPRESENTATIVE: _____ | _____ Date |
| | Name | |
| | CONTRACT ADMINISTRATOR'S QA REPRESENTATIVE: _____ | _____ Date |
| | Name | |
| | CONTRACT ADMINISTRATOR: _____ | _____ Date |
| | Name | |

Section 11 5311.10 - Attachment 3
List of Required Submittals

The following list of required submittals is an example of the submittals required in association with glovebox fabrication. This list is not comprehensive. Modify the list accordingly and provide the submittal requirements for project-specific gloveboxes with Section 01 3300 – Submittals.

***Note: The (1) NQA-1 shipment copy is delivered to Facility Management Unit for record deposition.**

| Section No: 11610 | | Type of Submittal | | | Submittal Schedule and Number of Copies | | | | |
|-----------------------------------|--|-------------------|---|-----------------------------|---|-----------------------|---------------|-------------------------------|-------------|
| Section Title: Gloveboxes | | | | | | | | | |
| DESCRIPTION OF SUBMITTAL REQUIRED | | FOR INFORMATION | FOR ENGINEERING REVIEW, COMMENT, & APPROVAL | FOR INSPECTION & ACCEPTANCE | AT PREFABRICATION CONFERENCE | PRIOR TO FRABRICATION | WITH SHIPMENT | 7 WORKING DAYS ADVANCE NOTICE | AS REQUIRED |
| | As-Built Drawings | X | | | | | 1 | | |
| | Lower Tier Services Plan | X | | | 1 | | 1 | | |
| | Fabrication Schedule | X | | | 1 | | 1 | | |
| | Bill of Lading | X | | | | | 1 | | |
| | Quality Assurance Manual (Fabrication) | X | | | 1 | | 1 | | |
| | Fabrication and Quality Control (QC) Procedures (Include Rev # or Date): | | | | | | | | |
| | Welding Procedure Specifications (WPS) | | X | | | 1 | | | |
| | Welding Procedure Qualification Record (PQR) | | X | | | 1 | | | |
| | Material Control Procedure | | X | | | 1 | | | |
| | Shop Traveler Procedure | | X | | | 1 | | | |
| | Cleaning Procedure | | X | | | 1 | | | |
| | Packaging Procedure | | X | | | 1 | | | |
| | Leak Test Procedure | | X | | | 1 | | | |
| | Liquid Penetrant Test Procedure | | X | | | 1 | | | |
| | Stud Test Procedure | | X | | | 1 | | | |
| | Calibration Procedure | | X | | | 1 | | | |

| Section No: 11610 | | Type of Submittal | | | Submittal Schedule and Number of Copies | | | | |
|-----------------------------------|--|-------------------|---|-----------------------------|---|-----------------------|---------------|-------------------------------|-------------|
| Section Title: Gloveboxes | | | | | | | | | |
| DESCRIPTION OF SUBMITTAL REQUIRED | | FOR INFORMATION | FOR ENGINEERING REVIEW, COMMENT, & APPROVAL | FOR INSPECTION & ACCEPTANCE | AT PREFABRICATION CONFERENCE | PRIOR TO FRABRICATION | WITH SHIPMENT | 7 WORKING DAYS ADVANCE NOTICE | AS REQUIRED |
| | Dimension mapping procedure | | X | | | 1 | | | |
| | Welding & NDE Personnel List | X | | | 1 | | | | |
| | Personnel Qualifications: | | | | | | | | |
| | Welder Performance Qualification Records | | X | | | 1 | 1 | | |
| | NDE Personnel Certifications | | X | | | 1 | 1 | | |
| | Q.A. Document Package: | | | | | | | | |
| | Test Reports: | | | | | | | | |
| | Stud Test | | | X | | | 1 | | |
| | Liquid Penetrant Test | | | X | | | 1 | | |
| | Leak Test | | | X | | | 1 | | |
| | Torque Map | | | X | | | 1 | | |
| | Dimensional Control Map | | | X | | | 1 | | |
| | Cutout flatness grid map | | | X | | | 1 | | |
| | Material Certifications: | | | | | | | | |
| | Stainless Steel for Shell | | | X | | | 1 | | |
| | Other Stainless Steel Items | | | X | | | 1 | | |
| | Lead | | | X | | | 1 | | |
| | Weld Filler Materials | | | X | | | 1 | | |
| | Chloride Content | | | X | | | 1 | | |
| | Shop Traveler, Completed | | | X | | | 1 | | |
| | Certificates of Compliance | | | X | | | 1 | | |
| | Supplier Deviation Disposition Request | | X | | | | 1 | | 1 |
| | Notification for Inspection of Weld Fit-up | X | | | | | | 1 | |
| | Notification for Inspection of Lead Placement | X | | | | | | 1 | |
| | Notification for Acceptance Testing & Final Inspection | X | | | | | | 1 | |

Section 11 5311.10 - Attachment 4
Guide to Suspect Fasteners

From *LANL Purchase Order Quality Clauses, January 1995, Form 838c (ST 2683), page 4 of 5* (from <http://labs.ucop.edu/internet/sps/lanl.html>, select SI 46.1 at <http://labs.ucop.edu/internet/sps/lanl/46-1.pdf>, then pdf page 12):

26. Suspect/Counterfeit Fasteners

LANL will not accept any hex-head cap screws (bolts) with any manufacturer's insignia identified on the attached Suspect Fastener Headmark List.

27. Suspect/Counterfeit Flanges

LANL will not accept any foreign manufactured flange and specifically any flange identified as China A-105 B16.

To access the Suspect/Counterfeit Fastener headmark list, open <http://twilight.saic.com/qawg/training.htm> , then open Suspect/Counterfeit Item booklet, click on View S/CI Booklet <http://www.qmo.bnl.gov/DOESCI/bkltview.pdf>, and open to page 23-24.

Section 11610 - Attachment 5
Inspection Data Sheet -- Glovebox

| INSPECTION DATA SHEET – GLOVEBOX | | | |
|--|---|---------------------|------------|
| Supplier: | Purchase Order No.: | Date of Inspection: | Inspector: |
| <div style="background-color: #cccccc; padding: 2px; margin-bottom: 5px;">FABRICATION PHASE</div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><input type="checkbox"/> Review of QA documentation</p> <p><input type="checkbox"/> Placement of lead sheet prior to installation of stainless steel cladding</p> </div> <div style="width: 45%;"> <p><input type="checkbox"/> Dimensional inspection weld fit-up</p> </div> </div> <div style="background-color: #cccccc; padding: 2px; margin-bottom: 5px;">SHOP ACCEPTANCE TEST</div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><input type="checkbox"/> Review of QA documentation</p> <p><input type="checkbox"/> Final dimensional inspection</p> </div> <div style="width: 45%;"> <p><input type="checkbox"/> Inspection of enclosure welds</p> <p><input type="checkbox"/> Inspection of enclosure surface finish</p> </div> <div style="width: 45%;"> <p><input type="checkbox"/> Helium Leak Test</p> </div> </div> <div style="background-color: #cccccc; padding: 2px; margin-bottom: 5px;">SHIPPING AND DELIVERY</div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><input type="checkbox"/> Inspection at the delivery site</p> </div> <div style="width: 45%;"> <p><input type="checkbox"/> Review of QA documentation</p> <p><input type="checkbox"/> Final Acceptance package</p> </div> </div> | | | |
| Inspection results and comments: | | | |
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| Cite the specific QA documentation that was reviewed: | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INSPECTION APPROVALS | <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved <input type="checkbox"/> Approved as noted below | | |
| | | | |
| | | | |

INSPECTORS SIGNATURE:

DATE:

C.A.T.R APPROVAL:

DATE: